An experimental study of the behavioral response of fish to flow changes in a near-natural environment

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The conservation and improvement of fish habitat occupy a major place in ecological restoration. As an important carrier of river systems, fish are connected in the study of the relationship between flow regime, biota, and ecosystem processes. However, there were significant differences in fish behavior between natural and laboratory conditions. It is extremely important to conduct comprehensive studies on fish behavior under controlled conditions in terms of hydraulics, ecology, and physiology based on large test sites.

The study is based on a large ecological test site in Sichuan, China, which has a natural river channel directly connected to the Dadu River. The flow rate of the river can be adjusted in real-time by changing the opening of the river inlet and outlet gates. The fish behavior is monitored using a radio frequency Identification system, with multiple monitoring sections (mainstream, left bank, and right bank) set up in the test section. When the test fish passes through the measurement section, the system can receive the unique signal from the PIT tag on the fish in real-time. Through the frequency and timing of tag signals collected between different river segments, the behavior trajectory of test fish in the turbid river can be inferred.

The study shows that: (1) Fish behavior tracking method based on PIT radio frequency Identification system is feasible in small natural rivers; (2) The test fish reduce their upstream expectation after a certain flow threshold is reached and change their upstream trajectory with the change of flow; (3) There is no significant difference in the activity of the test fish during the day and night, but they would reach their most active state at the appropriate flow. (4) After long swimming sessions, the more active fish became longer in body length, but muscle composition (crude protein and fiber) did not change significantly compared with inactive fish.